IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.	:	10/692,827	Confirmation No.: 9211
Applicant(s)	:	Baiyi ZHAO et al.	
Filed	:	October 24, 2003	
TC/A.U.	:	1793	
Title	:	*Late Transition Metal Catalysts for Olefin Oligomerizations*	
Examiner	:	James E. McDONOUGH	
Docket No.	:	2002B130A/2	
Customer No.	:	23455	
Date	:	December 23, 2009	

Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF SUBMITTED UNDER 37 C.F.R. § 41.31

This Appeal Brief is filed within four months of a previous notice of appeal filed on September 4, 2009. A petition for a two month extension of time is attached hereto. In the event it becomes separated from this appeal brief, the Commissioner is authorized to debit deposit account number 05-1712 for the necessary fees to make this paper timely.

I. REAL PARTY IN INTEREST

The real party in interest in this appeal is ExxonMobil Chemical Patents, Inc., assignee of record, which is a wholly owned affiliate of Exxon Mobil Corporation.

II. RELATED APPEALS AND INTERFERENCES

There is one related appeal or interference. USSN 10/693,584, filed October 24, 2003 is also appealed. No decisions have been reached as of the filing date of this Brief.

III. STATUS OF THE CLAIMS

As of the filing date of this appeal brief:

Claims 43-56, 64 and 65 stand rejected.

Claims 41, 57-63 and 66 are withdrawn.

Claims 1-40, 42 have been cancelled.

The rejection of claims 43-56, 64 and 65 is appealed.

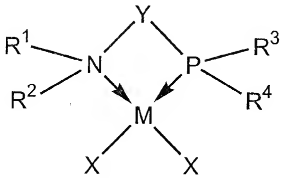
IV. STATUS OF THE AMENDMENTS

Applicant's Amendment dated January 29, 2009 has been entered.

There are no other amendments that have not been entered.

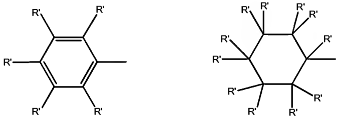
V. SUMMARY OF THE CLAIMED SUBJECT MATTER

The present invention as claimed is directed to a catalyst system comprising an activator (activator selected from the group consisting of alumoxane, aluminum alkyl, alkyl aluminum halide, alkylaluminum alkoxide, discrete ionic activator, and Lewis acid) and catalyst compound having the following formula:



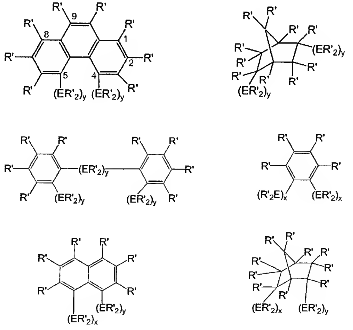
wherein: (i) M is Ni, Fe, Co, Pd, or Pt; (ii) N is nitrogen and is bonded to M; (iii) P is

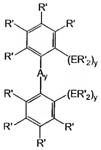
phosphorus and is bonded to M; (iv) R^1 and R^2 are independently selected from the group consisting of methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl dodecyl, cyclobutyl, cyclohexyl, phenyl, benzyl, phenethyl, tolyl, cyclopentyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, and cyclododecyl; (v) R^3 and R^4 are independently selected from the group consisting of methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl dodecyl, cyclobutyl, cyclohexyl, phenyl, benzyl, phenethyl, tolyl, cyclopentyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, cyclododecyl and substituents represented by the formulas:

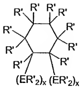


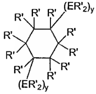
where R' are independently, hydrogen or C_1-C_{50} hydrocarbyl radicals, and any two adjacent R' may independently be joined to form a saturated or unsaturated cyclic structure;

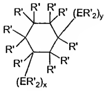
(vi) Y is butenyl or has one of the following formulas:

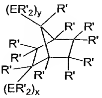


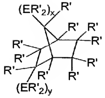


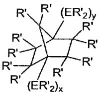


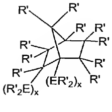


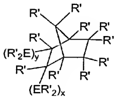


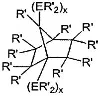


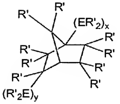


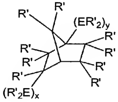












where: (a) R' are independently hydrogen or C_1-C_{50} hydrocarbyl radicals; (b) A is a non-hydrocarbon atom functional group; (c) E is a Group-14 element; (d) x is an integer from 1 to 4; and (e) y is an integer from 0 to 4; and (vii) X are independently selected from the group consisting of chloride, bromide, iodide, methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, methoxide, ethoxide, dimethylamide, diethylethoxide, and phenoxide,

wherein the olefin polymerization or oligomerization catalyst system exhibits an activity that exceeds 8000 moles of ethylene per mole of M per hour.

The description of Applicant's catalyst system is found at pages 6 to 15, and the originally filed claims, particularly originally filed claims 2-20, and 28 -31 of the specification.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The rejections to be reviewed on appeal are:

1. Whether the catalyst systems described in claims 43-49 are obvious under 35 U.S.C. § 103(a) over J. Am. Chem. Soc. 1999, 121, 7714-15 (Kocovsky) in view of US 6,307,087 ("Buchwald") in further view of US 5,658,982 (Baardmann) as evidenced by US2002/0197731 (McFarland) and US 2003/0032808 (Peters).
2. Whether the catalyst compounds described in claims 50-55, 64 and 65 are obvious under 35 U.S.C. § 103(a) over J. Am. Chem. Soc. 1999, 121, 7714-15 (Kocovsky) in view of US 6,307,087 ("Buchwald") in further view of US 5,658,982 (Baardmann) as evidenced by US2002/0197731 (McFarland) and US 2003/0032808 (Peters) in further view of US 6,262,196 (Meeking).
3. Whether the catalyst systems described in claim 56 are obvious under 35 U.S.C. § 103(a) over J. Am. Chem. Soc. 1999, 121, 7714-15 (Kocovsky) in view of US 6,307,087 ("Buchwald") in further view of US 5,658,982 (Baardmann) as evidenced by US2002/0197731 (McFarland) and US 2003/0032808 (Peters) in further view of US 2002/0107342 (Mawson).
4. Whether the catalyst compounds described in claims 43-56, 64 and 65 are obvious under the judicially created doctrine of obviousness-type double patenting over claims 2-6 and 9-17 of USSN 10/693,584, filed October 24, 2003.

VII. ARGUMENT

The art relied upon in the rejection of the claims under appeal is listed below:

1. J. Am. Chem. Soc. 1999, 121, 7714-15 ("Kocovsky");
2. US 6,307,087 ("Buchwald");
3. US 5,658,982 ("Baardmann");
4. US2002/0197731 ("McFarland");
5. US 2003/0032808 ("Peters");
6. US 6,262,196 ("Meeking");

7. US 2002/0107342 ("Mawson"); and

8. USSN 10/693,584.

Argument in Response to Rejection 1.

Claims 43-49 are rejected under 35 USC § 103(a) as being unpatentable over J. Am. Chem. Soc. 1999, 121, 7714-15 (Kocovsky) in view of US 6,307,087 (Buchwald) in further view of US 5,658,982 (Baardmann) as evidenced by US2002/0197731 (McFarland).

As stated in MPEP § 2141, the criteria set out in Graham v. John Deere (383 US 1, 148 USPQ 459(1966)) are used to asses obviousness. These are "..the scope and content of the prior art are to be determined, differences between the prior art and the claims at issue are to be ascertained and the level of ordinary skill in the pertinent art resolved."

The scope and content of the prior art: Kocovsky and Buchwald discloses ligand-metal complexes and methods to use them in small molecule reactions, such as allylic substitutions, amination, and Suzuki coupling (Kocovsky page 7714, first paragraph) and Suzuki coupling, amination, diaryl ether synthesis, ketone arylation and Heck reactions (Buchwald Figure 1, column 1, line 65- to column 2, line 1). Kocovsky and Buchwald are for use in small molecular synthesis and do not relate to olefin oligomerizations/polymerizations and catalyst systems for such.

The differences between the prior art and the claims at issue: Applicants claimed invention as a whole relates to a catalyst system for olefin polymerizations comprising an activator and a catalyst compound, where the catalyst compound is a metal atom (specifically iron, cobalt, nickel, palladium or platinum) bound to a bidentate ligand through a nitrogen atom and through a phosphorus atom, where a hydrocarbyl bridge connects the nitrogen and phosphorus atoms. This catalyst system is used for olefin polymerization, not small molecule reactions. With the activator present it is unlikely it would be useful for small molecule reactions.

Applicant's claimed invention differs from the prior art in that the prior art alone (or in combination) does not disclose the catalyst system which is a combination the activator and the catalyst compound, much less the compound of a metal atom specifically of iron, cobalt, nickel,

palladium or platinum bound to a bidentate ligand through a nitrogen atom and through a phosphorus atom where a hydrocarbyl bridge connects the nitrogen and phosphorus atoms and its use as a polymerization catalyst, particularly one that has an activity exceeding 8000 moles of ethylene per mole of metal, M, per hour.

The level of ordinary skill in the pertinent art: With regard to the level of skill in the art, it has long been established that catalysis is generally considered unpredictable merely from the chemical nature of the catalyst. Corona Co. V. Dovan (USSC 1928) 276 US 358, 369. Catalytic effects are not ordinarily predictable with certainty. In re Doumani et al. (CCPA 1960) 281 F.2d 215, 126 USPQ 408.

The Examiner suggests that Kocovsky teaches a catalyst compound that if modified by Buchwald would fall within Applicant's claims. Applicant respectfully disagrees. Applicant's claims are to catalyst systems which require an activator. The Examiner admits that Kocovsky and Buchwald do not disclose the use of an activator. The Examiner then suggests that it would be obvious to add a polymerization activator (such as the one in Baardman) to Kocovsky as modified by Buchwald. Applicant respectfully disagrees. One of ordinary skill in the art would not think to combine a *small molecule* catalyst (such as those disclosed in Kocovsky with or without Buchwald) with *parts* of a *polymerization* catalyst system. Kocovsky's catalysts (alone and as modified by Buchwald) make small molecules, e.g. amination, arylation. Kocovsky's compound is not shown to make a completely different material, like Applicant's polymers. This is an important distinction because as a general rule small molecule catalysts change a single molecule in some way (aminate it, arylate it, etc) whereas oligomerization/polymerization catalysts take multiple molecules and string them together into chains with multimeric repeat units (typically on the order of 10's to 1000's or even 10,000's of units or more). This is a fundamentally different way of performing chemistry. One of ordinary skill in the art does not look to a coupling catalyst or amination catalyst to make a polymer or oligomer, particularly one with a commercially viable activity (e.g., exceeding 8000 moles ethylene per mole of metal, M, per hour). As evidence to support this conclusion please see the Dr. Canich's declaration attached hereto.

Finally, the Examiner has offered no basis, and Applicant can also find no basis in the record, for combination of a concept applicable to catalytic complexes for making olefin

polymers with late transition metal-diphosphine/phosphoamine ligand complexes disclosed for functionalized compounds or asymmetrically substituted small molecules (Kocovsky/Buchwald). As such, even the combination of Kocovsky, Buchwald and Baardman does not disclose or suggest all the elements of the currently pending claims and thus does not render obvious the claimed invention.

Furthermore, the "evidence" of McFarland and Peters does not cure these deficiencies. McFarland and Peters are cited by the Examiner as evidence for the general concept that "catalyst can be used to catalyze more than one type of reaction." (page 4, Office action dated 5/13/09) Applicant respectfully disagrees. McFarland relates to a high throughput method for spectroscopic imaging of libraries which could be used for any of a number of compounds, including from peptides to heterogeneous and homogeneous catalyst compounds. McFarland (particularly paragraph [0054] cited by the Examiner) does not stand for the proposition that a single catalyst may be used for a multitude of reactions, McFarland stands for the proposition that the testing technique McFarland is claiming can be used with a multitude of compounds, including the list of kinds of catalysts at paragraph [0054]. In contrast Peters at paragraph [0116] does state that the "amido ligand transition metal complexes of the invention *are expected to* find utility as catalysts in numerous stoichiometric and catalytic transformations…." (emphasis added) and then lists 15 different reactions that might be possible. This language, however, is not enough in the unpredictable world of catalytic chemistry to teach one of ordinary skill in the art how to perform the specific reactions and which ones will actually work, particularly in commercially useful ways. Expectations and research plans are not sufficient as prior art. While obviousness does not require absolute predictability, at least some degree of predictability is required (see MPEP § 2143.02). The attached declaration from Dr. Canich provides evidence that one of ordinary skill in the art would not have expected Applicant's invention to work, despite the "expectations" listed in Peters' paragraph [0016].

Looking at the above rejection it is clear the Examiner is employing the forbidden tool of hindsight using Applicant's claims as a road map to find the various pieces of the claimed invention and then cobble them together. This is impermissible. Applicant respectfully submits that the Examiner cannot merely cite portions of references and generalize their applicability to cobble together a rejection asserting that a selective combination of such scattered elements (or, even worse, a combination of such scattered

elements <u>and</u> some elusive knowledge of an alleged skilled artisan) without a motivation or suggestion for one of ordinary skill in the art to do so. The number of elements of the cited prior art that one of ordinary skill in the art would have had to ignore, alter, generalize, or reason away in contradiction of the references themselves in order to attain the claimed invention seems to be more than the number of elements from the cited prior art on which the Examiner relies to render obvious the claimed invention. In light of the above, Applicant respectfully submits that the claimed invention is not obvious from (Kocovsky) in view of Buchwald in further view of Baardmann as evidenced by McFarland and Peters and requests the rejection be withdrawn.

<u>Argument in Response to Rejection 2.</u>

Claims 50-55, 64 and 65 are rejected under 35 U.S.C. § 103(a) as obvious over J. Am. Chem. Soc. 1999, 121, 7714-15 (Kocovsky) in view of US 6,307,087 ("Buchwald") in further view of US 5,658,982 (Baardmann) as evidenced by US2002/0197731 (McFarland) and US 2003/0032808 (Peters) in further view of US 6,262,196 (Mecking).

The arguments enumerated above apply to the instant rejection. As discussed above, the combination of Kocovsky/Buchwald/Baardmann with the "evidence" of McFarland and Peters does not disclose or suggest the claimed invention. Further, Mecking does not cure the deficiencies discussed above. The Examiner suggests that Mecking discloses various compounds useful as activators in polymerization reactions. Even if this is true, there is no credible scientific reason on the record as to why one of ordinary skill in the art would have combined these references. As discussed above, one of ordinary skill in the art would not think to combine a *small molecule* catalyst with *parts* of various *polymerization* catalyst systems. Kocovsky's catalysts (alone and as modified by Buchwald) make small molecules, e.g. amination, arylation. Kocovsky's compound is not shown to make a completely different material, like Applicant's polymers and nothing within Mecking alone or combined with Kocovsky/Buchwald/ Baardmann/McFarland/Peters, teaches Applicant's specific catalyst systems comprising activators. One of ordinary skill in the art does not look to a coupling catalyst or amination catalyst to make a polymer or oligomer. As evidence to support this conclusion please see Dr. Canich's declaration attached hereto.

In light of the above, Applicant respectfully requests the rejection be withdrawn.

Argument in Response to Rejection 3.

Claim 56 is rejected under 35 U.S.C. § 103(a) as obvious over J. Am. Chem. Soc. 1999, 121, 7714-15 (Kocovsky) in view of US 6,307,087 ("Buchwald") in further view of US 5,658,982 (Baardmann) as evidenced by US2002/0197731 (McFarland) and US 2003/0032808 (Peters) in further view of US 2002/0107342 (Mawson).

The arguments enumerated above apply to the instant rejection. As discussed above, the combination of Kocovsky/Buchwald/Baardmann/McFarland and Peters does not disclose or suggest the claimed invention. Mawson does not cure the deficiencies noted above. The Examiner suggests that Mawson discloses mixing one catalyst with an activator and later adding a second catalyst with the expectation of obtaining a bimodal polymer. Applicant respectfully disagrees and notes that even if what the Examiner suggests is true, there is no credible scientific reason on the record as to why one of ordinary skill in the art would have combined these references. As discussed above, one of ordinary skill in the art would not think to combine a *small molecule* catalyst with miscellaneous *parts* of several *polymerization* catalyst systems. Kocovsky's catalysts (alone and as modified by Buchwald) make small molecules, e.g. amination, arylation. Kocovsky's compound is not shown to make a completely different material, like Applicant's polymers and nothing within Mawson alone or combined with Kocovsky/Buchwald/ Baardmann/McFarland/Peters, teaches Applicant's specific catalyst systems comprising activators. One of ordinary skill in the art does not look to a coupling catalyst or amination catalyst to make a polymer or oligomer. As evidence to support this conclusion please see Dr. Canich's declaration attached hereto.

In light of the above, Applicant respectfully requests the rejection be withdrawn.

Dr. Canich's Declaration

With regard to Dr. Canich's declaration, which, as the Appeals board will recognize, is sworn testimony, Applicant submits that the Examiner has neither given the sworn evidence due weight nor appropriately rebutted on the record. If the Examiner wishes to contest the validity of statements made in the Declaration, it is proper that he do more than offer mere Examiner argument or conclusory statements to do so – he must take Official Notice, cite published prior art contradicting this sworn testimony, or offer contradictory sworn testimony based on clear scientific reasoning (*e.g.*, in the form of a declaration or affidavit), if he wishes to cast sufficient doubt over its validity to put the burden of proof

back on Applicant. *See In re Zurko*, 258 F.3d 1379, 1385, 59 USPQ2d 1693, 1697 (Fed. Cir. 2001) ("[T]he Board [or an examiner] cannot simply reach conclusions based on its own understanding or experience or on its assessment of what would be basic knowledge or common sense. [T]he Board [or an examiner] must point to some concrete evidence in the record in support of these findings [to satisfy the substantial evidence test]. If the examiner is relying on <u>*personal knowledge to support the finding of what is known in the art, the examiner must provide an affidavit or declaration*</u> setting forth specific factual statements and explanation to support the finding. The Board [or an examiner] cannot rely on conclusory statements when dealing with particular combinations of prior art and specific claims, but must set forth the rationale on which it relies.") (Emphasis added); *see also* M.P.E.P. § 2144.03. Thus, the Examiner cannot ignore the Canich Declaration simply because he disagrees with it. The Declaration, particularly this declaration which is supported by scientific reasoning *in the declaration*, must be considered as evidence by the Examiner and not summarily dismissed. Applicant respectfully submits that Dr. Canich's conclusions, supported by clear and unchallenged reasoning, take precedence over the Examiner's conclusory statements.

Specifically the Examiner has several conclusory statements in the Office action dated May 13, 2009, but none of them are backed up as required by taking Official Notice, citing published prior art contradicting this sworn testimony, or offering contradictory *sworn* testimony based on clear scientific reasoning (*e.g.*, in the form of a declaration or affidavit). Thus Applicant submits that the Sworn evidence in the declaration takes precedence over the Examiner's conclusory statements.

<u>Limitation in the Preamble</u>

Further, Applicant also respectfully submits that the Examiner has also not given due weight to the limitation Applicant has amended into the preamble of the claims. Specifically Applicant respectfully submits that the Examiner has long ignored the amendment to Applicant's preamble regarding the catalyst system claims, in which what had previously been merely recited a catalyst system was amended to recite "[a]n <u>olefin polymerization or oligomerization</u> catalyst system …." It has been previously asserted by Applicant that the requirement of the catalyst being an <u>olefin polymerization or oligomerization</u> catalyst, though

admittedly in the claim preamble, is a distinction from the cited prior art that should be given patentable weight. There is no evidence that the Examiner has done so.

Indeed, the inclusion of "olefin polymerization or oligomerization" in the preamble of the claim indicates that the olefin polymerization/oligomerization characteristic of the catalyst is a required feature of Applicant's claimed invention. Olefin polymerization or oligomerization names the catalyst system, and, as such, provides context for the system and breathes life into the claim. Applicant is therefore affirmatively relying herein on this characteristic for establishing patentability over the cited prior art, which necessarily transforms any preamble statement into a claim term that should be given its due patentable weight. *See* M.P.E.P. § 2111.02, *citing Metabolite Labs., Inc. v. Corp. of Am. Holdings*, 370 F.3d 1354, 1358-62 (Fed. Cir. 2004), and *quoting Catalina Mktg. Int'l. v. Coolsavings.com, Inc.*, 289 F.3d at 808-09 ("[C]lear reliance on the preamble during prosecution to distinguish the claimed invention from the prior art transforms the preamble into a claim limitation....").

Thus, when given its due weight, the limitation distinguishes the claimed invention over the references Kocovsky/Buchwald/Baardmann/McFarland and Peters or Mawson. This combination does not suggest using Applicants catalyst system in olefin polymerization or oligomerization and the limitation makes this requirement clear.

Argument in Response to Rejection 4.

Claims 43-56, 64 and 65 have been rejected under the judicially created doctrine of obvious type double patenting (ODP) over claims 2-6 and 9-17 of USSN 10/693,584, filed October 24, 2003. Applicant respectfully disagrees.

Applicant notes that a similar rejection is made in USSN 10/693,584, over the instant application. Applicant further notes that, with regard to obviousness type double patenting rejections, if the applications have the same effective filing date (which 10/693,584 and the instant application do) according to MPEP § 804 I.B.1, "*the examiner should determine which application claims the base invention and which application claims the improvement (added limitations). The ODP rejection in the base application can be withdrawn without a terminal disclaimer.*" Applicant respectfully requested that the Examiner make the determination of which application is the "base" application and which application is the "improvement" application. The Examiner refused to do so.

Likewise, Applicant notes that the claims in 10/693,584 are to a catalyst compound not to a catalyst system (e.g. the compound and the activator), while the claims in the instant application are to the catalyst system. The Examiner forced Applicant to withdraw similar claims in USSN 10/693,584 drawn to a catalyst system (Invention II) in the office action dated November 5, 2005. It is inconsistent for the Examiner to say that the *catalyst system* claims in one related application are patentably distinct from compound claims and must be withdrawn for purposes of restriction, yet the *catalyst system* claims in another application are not patentably distinct from compound claims for purposes of double patenting. Applicant respectfully requests that the rejection be withdrawn.

Prayer

Applicant respectfully requests that the rejections under the doctrine of obviousness-type double patenting, 35 USC § 102 and 35 USC § 103 be withdrawn.

Respectfully submitted,

December 23, 2009
Date

/Catherine L. Bell/
Catherine L. Bell
Registration No. 35,444

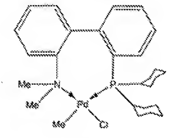
ExxonMobil Chemical Company
Law Technology
P.O. Box 2149
Baytown, Texas 77522-2149
(281) 834-5982 Voice
(281) 834-2495 Facsimile

VIII. APPENDIX: Listing of Claims

Listing of Claims: **AS AMENDED on January 29, 2009**

1. to 40. (Cancelled)

41. (Withdrawn) The catalyst system of claim 43, wherein the catalyst precursor has the formula:



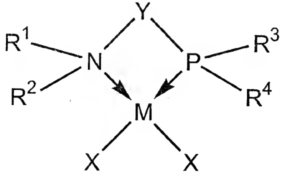
Formula XXIII

42. (Cancelled)

43. (New) An olefin polymerization or oligomerization catalyst system comprising the reaction product of:

(a) an activator selected from the group consisting of alumoxane, aluminum alkyl, alkyl aluminum halide, alkylaluminum alkoxide, discrete ionic activator, and Lewis acid; and

(b) a catalyst precursor having the following formula:



wherein:

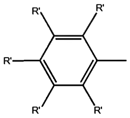
(i) M is Ni, Fe, Co, Pd, or Pt;

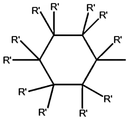
(ii) N is nitrogen and is bonded to M;

(iii) P is phosphorus and is bonded to M;

(iv) R^1 and R^2 are independently selected from the group consisting of methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl dodecyl, cyclobutyl, cyclohexyl, phenyl, benzyl, phenethyl, tolyl, cyclopentyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, and cyclododecyl;

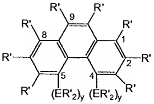
(v) R^3 and R^4 are independently selected from the group consisting of methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl dodecyl, cyclobutyl, cyclohexyl, phenyl, benzyl, phenethyl, tolyl, cyclopentyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, cyclododecyl and substituents represented by the formulas:

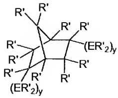


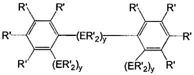


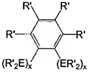
where R' are independently, hydrogen or C_1-C_{50} hydrocarbyl radicals, and any two adjacent R' may independently be joined to form a saturated or unsaturated cyclic structure;

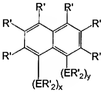
(vi) Y is butenyl or has one of the following formulas:

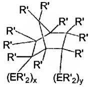


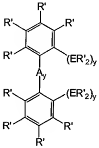


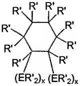


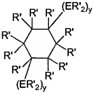


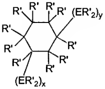


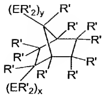


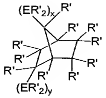


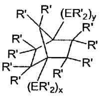


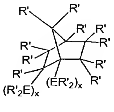


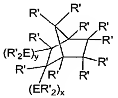


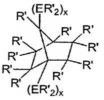


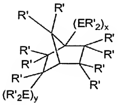


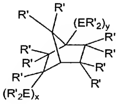












where:

(a) R' are independently hydrogen or C_1-C_{50} hydrocarbyl radicals;

(b) A is a non-hydrocarbon atom functional group;

(c) E is a Group-14 element;

(d) x is an integer from 1 to 4; and

(e) y is an integer from 0 to 4; and

(vii) X are independently selected from the group consisting of chloride, bromide, iodide, methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, methoxide, ethoxide, dimethylamide, diethylethoxide, and

phenoxide,

wherein the olefin polymerization or oligomerization catalyst system exhibits an activity that exceeds 8000 moles of ethylene per mole of M per hour.

44. (Previously Presented) The catalyst system of claim 43, wherein R^3 and R^4 are selected from the group consisting of cyclohexyl, phenyl, benzyl, phenethyl, and tolyl.

45. (Previously Presented) The catalyst system of claim 43, wherein R^1, R^2, R^3, and R^4 are independently selected from the group consisting of methyl, ethyl, propyl, butyl, cyclohexyl, phenyl, tolyl, benzyl, and phenethyl.

46. (Previously Presented) The catalyst system of claim 43, wherein A is selected from the group consisting of C=O, C=S, O, S, SO_2, NR*, PR*, BR*, SiR^*_2, and GeR^*_2, where R* is independently a hydrocarbyl or halocarbyl radical.

47. (Previously Presented) The catalyst system of claim 43, wherein Y is biphenyl.

48. (Previously Presented) The catalyst system of claim 43, wherein X are independently chloride, bromide, iodide, methoxide, ethoxide, dimethylamide, diethylethoxide, or phenoxide.

49. (Previously Presented) The catalyst system of claim 43, wherein the activator comprises $B(C_6F_5)_3$ or $B(C_6H_5)_3$.

50. (Previously Presented) The catalyst system of claim 43, wherein the activator comprises a cyclic oligomeric aluminum compound represented by the formula $(R''\text{-Al-O})_n$, or a linear oligomeric aluminum compound represented by the formula $R''(R''\text{-Al-O})_nAlR''_2$, wherein R" is independently a C_1-C_{20} alkyl radical, and wherein n is an integer from 1-50.

51. (Previously Presented) The catalyst system of claim 43, wherein the activator is methylalumoxane.

52. (Previously Presented) The catalyst system of claim 43, wherein the activator is triethylaluminum, diethylaluminum chloride, triisobutylaluminum, tri-n-octylaluminum, or a combination thereof.

53. (Previously Presented) The catalyst system of claim 43, wherein the activator is $[Me_2PhNH][B(C_6F_5)_4]$, $[Bu_3NH][BF_4]$, $[NH_4][PF_6]$, $[NH_4][SbF_6]$, $[NH_4][AsF_6]$, $[NH_4][B(C_6H_5)_4]$, $B(C_6F_5)_3$, $B(C_6H_5)_3$, or a combination thereof.

54. (Previously Presented) The catalyst system of claim 43, wherein the catalyst is deposited on a solid support, the solid support comprising polymeric materials or refractory oxide materials.

55. (Previously Presented) A catalyst system comprising the reaction product of:

(a) the catalyst system of claim 43 and

(b) olefin monomer(s) comprising ethylene, propylene, 1-butene, or a mixture of any two or all three of ethylene, propylene, and 1-butene.

56. (Previously Presented) The catalyst system of claim 43, further comprising at least one additional olefin polymerization catalyst.

57. (Previously Presented) An oligomerization or polymerization method comprising contacting at least one catalyst system of claim 43 with alpha-olefin comprising ethylene, wherein the catalyst's activity exceeds 8000 moles of ethylene per mole of M per hour.

58. (Previously Presented) The method of claim 57, further comprising recovering a product comprising greater than 50 mol% of linear C_4-C_{14} alpha-olefins based on the total weight of polymerized product.

59. (Previously Presented) The method of claim 57, wherein the product comprises greater than 80 mol% of linear C_4-C_{14} alpha-olefins.

60. (Previously Presented) The method of claim 57, wherein the product comprises

greater than 50 mol% of linear C_4 and C_6 alpha-olefins.

61. (Previously Presented) The method of claim 57, wherein the product comprises greater than 80 mol% of linear C_4 and C_6 alpha-olefins.

62. (Previously Presented) The method of claim 57, comprising reacting

(a) the catalyst system and

(b) olefin monomer(s) comprising ethylene, propylene, 1-butene, or a mixture of any two or all three of ethylene, propylene, and 1-butene.

63. (Previously Presented) The method of claim 57, wherein the oligomerization or polymerization is run in the presence of an aprotic organic liquid.

64. (Previously Presented) The catalyst system of claim 43, further comprising an aprotic organic liquid.

65. (Previously Presented) The catalyst system of claim 55, wherein the olefin monomer(s) consists essentially of ethylene, propylene, 1-butene, and mixtures thereof.

66. (Previously Presented) The method of claim 62, wherein the catalyst system is reacted with olefin monomer(s) consisting essentially of ethylene, propylene, 1-butene, and mixtures thereof.

IX. APPENDIX: EVIDENCE

1. Canich Declaration dated July 7, 2008.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of :	§	Before the Examiner
Zhao et al.	§	James E. McDonough
Serial No. 10/692,827	§	Group Art Unit No. 1755
Filed: October 24, 2003	§	Attorney Docket Number: 2002B130A/2
For: Late Transition Metal Catalysts for Olefin Oligomerizations	§	Confirmation Number 9211
	§	
	§	Date: July 7, 2008
Customer No.: 23455		

Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

Declaration Under 37 C. F. R. § 1.132

Dear Sir:

This affidavit is submitted to offer a showing that:

1) Claims 1-20, 27-31 and 36-39 are both novel and non-obvious over Sumi (US 6,323,353) in view of Baardman (US 5,658,982) in further view of Qian (*Synthesis and Polymerization Behavior of Various Substituted Half-Sandwich Titanium Complexes Cp'TiCl$_2$(OR*) as Catalysts for Syndiotactic Polystyrene*, J. Mol. Cat. 208, 2004, 45-54.);

2) Claims 1-20, 27-31and 36-39 are both novel and non-obvious over Buchwald (US 6,307,087) in view Baardman in further view of Qian;

3) Claims 1-20, 27-31and 36-39 are both novel and non-obvious over Zhang in view of Baardman in further view of Qian;

4) Claim 40 is both novel and non-obvious over any of Sumi, Buchwald, or Zhang in view of Baardman in further view of Piekarski (US 3,991,259).

This affidavit is submitted concurrently with a response after final rejection to the final office action dated March 4, 2008, provided as the submission required under 37 CFR § 1.114 for a Request for Continued Examination.

I, Jo Ann Marie Canich, Ph.D. declare that:

1. I am a citizen of the United States residing in Houston, Texas.

2. I am a co-inventor of the above-referenced patent application referred to herein as the '827 Patent Application.

3. I have been continuously employed by ExxonMobil Chemical Company, (and its predecessor Exxon Chemical Company) since 1987 as a research scientist working in the area of olefin catalysis. I have over twenty years of direct experience in the olefin catalysis art and, among other things, have recently published a book (co-editor) in the area of olefin catalysis (*Steroselective Polymerization with Single-Site Catalysts*, Eds. Baugh & Canich, CRC Press, Boca Raton, FL, 2008). I have won multiple awards both inside my company and from industry for my work in the olefin catalysis field. Additional information regarding my technical and professional background is attached as a *Curriculum Vitae*.

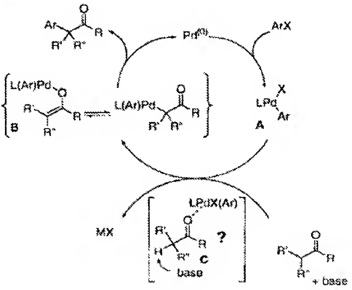
4. I have read the office action dated March 04, 2008 and have read each of the references cited therein, e.g. Sumi, Buchwald, Zhang, Qian, Baardman and Piekarski.

5. In my opinion one of ordinary skill in the olefin catalysis art reading Buchwald, Sumi and Zhang would find that Sumi, Buchwald and Zhang are directed to catalysts useful to make small molecules via metal mediated coupling reactions, but not polymerization or oligomerization catalyst compounds.

It is further my opinion that Buchwald does not disclose the pre-catalyst compounds or polymerization catalysts used in my patent application, and only discloses the use of the ligand in combination with a metal and a base such as an alkoxide, amide, phosphate, or carbonate. While the Examiner suggests that the reaction of the ligand with a metal will produce the pre-catalysts of my invention, this is not indicated in or supported by Buchwald. In fact, if one refers to *Journal of the American Chemical Society* 2000, 122, 1360 (Fox et al.), Fox et al. shows the proposed reaction scheme (Scheme 1, page 1366 - also shown below) for a small

molecule coupling reaction where the ligand, L, is shown in the chart on page 1362. The ligand labeled **3** can perform as an ancillary ligand where Y is biphenyl (referring to the formula in Claim 2 of the '827 application). On page 1366, Fox et al. states that in comparison to previous studies, that they believe the Pd:phosphine ratio when using ligands **4-7** for the reaction intermediates (**A** and **B**) is 1:1 (i.e. only one electron donating atom, in this case phosphorous, is needed). Note that ligands 4-7 are mono-dentate phosphorus ligands. Additionally, similar evidence suggests that the binding of the dimethylamino group of ligand **3** to Pd is not essential for the catalytic process and, in fact, may not occur at all. This is indicated by the similarities in the catalysis involved when using **3**, **6** and **7** in the Pd-catalyzed ketone arylations reported in the paper, in addition to Suzuki and amination reactions reported in references within. Note that ligands **6** and **7** do not contain the dimethylamino group as compared to ligand **3**. Hence, it would be speculative at best to assume that the reaction between ligand **3** and a metal would form the polymerization pre-catalyst of my invention, when the chemistry in small molecule coupling reactions suggests otherwise.

Scheme 1



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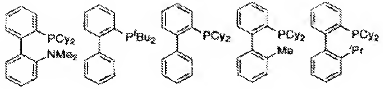
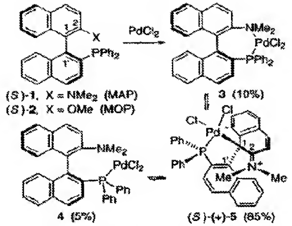


3 4 5 6 7

Fox et al. also states that it is possible that the interaction between the metal and the ligand in the Pd(II) intermediates complexes (**A** and **B**) is similar to those reported for the MOP and MAP ligands reported in *Journal of the American Chemical Society* 1999, 121, 7714 (Kocovsky et al.). Kocovsky et al. uses the binaphthyl ligand also reported in Sumi (but not an ancillary ligand in my application). Scheme 1 of Kocovsky et al. is shown below (p 7714). Kocovsky et al. indicates an equilibrium between species 3 (10%), 4 (5%) and 5 (85%) in solution, however, they were only able to isolate compound **5**, suggesting the preferred state of the molecule is complex **5**. This is based not only on the ability to isolate complex **5** in crystalline form which was structurally characterized by X-ray crystallography, but also on the solution equilibrium mixture being 85% complex **5**. Note that complex **5**, and also complex **4**, does not have a metal-nitrogen bond as required of my ancillary ligand in the claims. Again, it would be speculative to assume the reaction between the ligand of Buchwald would react to make the complexes of our application verses assuming other chemistry as suggested by Kocovsky.

Scheme 1



One should also note that the catalysis scheme for making small molecules via metal mediated catalysis as shown in Fox et al.'s Scheme 1 involves (1) starting with a Pd(0) complex and oxidizing it to Pd(II) by ArX to form intermediate A; (2) forming an interaction between intermediate A and an electron donor (a ketone in this case) in the presence of a base to form intermediate C; (3) abstraction of an acidic proton by the base to form intermediate B; and finally (4) reduction of intermediate C (Pd(II) down to Pd(0)) and formation of an arylated ketone. This is a catalytic cycle that involves multiple Pd species, and requires the ability to oxidize the metal to a higher oxidation state in order for the chemistry to occur, and then reduce the Pd back to Pd(0) to regenerate the catalyst and to "release" the new compound. The coupling mechanism for Buchwald is analogous to that represented by Fox et al. This is why Buchwald states in Column 32, line 7-8 that "the metal center is desirably in the zero-valent state or is capable of being reduced to metal (0)". The nickel and palladium species in my application are Ni(II) and Pd(II) and the catalytic cycle for olefin polymerization/oligomerization does not involve changing the oxidation state of the catalyst precursor, or of the catalyst species during the polymerization / oligomerization reaction.

For similar reasons, Sumi and Zhang do not disclose the pre-catalyst compounds or polymerization catalysts used in my patent application. Like Buchwald, both are directed toward small molecule synthesis using metal mediated catalysis.

- 5 -

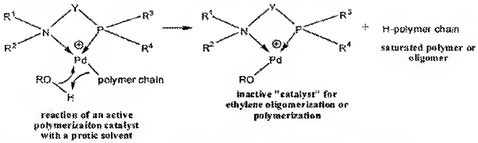
6. It is my further opinion that one of ordinary skill in the art would not combine a *polymerization catalyst activator* with the various compounds of Sumi, Buchwald and Zhang, because they do not need a *polymerization catalyst activator* to achieve their purpose of making small molecules using metal mediated coupling chemistry.

7. It is my further opinion that one of ordinary skill in the art reading Baardman would find Baardman is directed to certain Group 10 metal compounds used in combination with a borane activator to polymerize carbon monoxide and olefins in a variety of polymerization environments. Baardman shows that by increasing the amount of tris(perfluorophenyl)boron during the propylene/CO polymerization that the activity of the copolymerization can be enhanced. In this, Baardman teaches that you can "reactivate" your catalyst with additional amounts of tris(perfluorophenyl)boron. It is well known in the literature that oxidants are commonly added to this type of catalyst system to re-oxidize the Pd from the inactive Pd(0) complex to the active Pd(II) complex. It is also known that the presence of the oxidant can be avoided by using fluorinated alcohols as the polymerization solvent, hence, one of ordinary skill in the art would expect that a perfluorinated borate would act in a similar manner. See *Organometallics* 2000, 19, 3435.

While Baardman also teaches that a variety of diluents can be used, Baardman indicates that the liquid diluent to be used is one in which the copolymer to be prepared forms a suspension (i.e. is insoluble or virtually insoluble). Particularly preferred are mixtures of aprotic diluents and protic diluents because these provide a further improvement in maintaining the polymerization rate at the initial level. Protic diluents include lower alcohols such as methanol and ethanol while aprotic diluents can include ketones, chlorinated hydrocarbons and aromatics. (see col. 5, line 55 to col. 6 line 3).

8. It is my further opinion that one of ordinary skill in the art would not combine Baardman and Sumi, Buchwald or Zhang because polymerization catalyst activators are not needed to make the small molecules in Sumi, Buchwald and Zhang. In addition, some of Baardman's environments, such as the use of protic diluents would negatively affect the catalysts in Sumi, Buchwald and Zhang assuming such catalysts were being used for olefin oligomerization or polymerization (there are no teachings for such chemistry, as Sumi, Buchwald and Zhang are all directed toward

small molecule synthesis involving metal mediated coupling chemistry). For olefin polymerization or oligomerization, a protic diluent would be expected to act as a chain termination agent forming a saturated oligomer or a polymer with a saturated end-group. The catalyst would be deactivated in the process. An activator such as tris(perfluorophenyl)boron would not be capable of reactivating the catalyst for olefin oligomerization or polymerization. This reaction is illustrated below:



This is not an issue with the catalyst system of Baardman, as CO (but not ethylene or propylene or any alpha-olefin) would be capable of inserting in the Pd-OR bond. Thus, in my opinion, the teaching from Baardman, assuming one would think of using Buchwald, Zhang or Sumi for polymerization catalysts, would in fact lead to an inactive system for the polymerization or oligomerization of olefins. For a fundamental understanding of olefin/CO copolymerizations, see Nozaki, K, Tacticity in Ethylene/Carbon Monoxide/Vinyl Co- and Terpolymerizations. In *Stereoselective Polymerization with Single-Site Catalysts*; Baugh, L.S., Canich, J.M., Eds.; CRC Press: Boca Raton, FL, 2008; pp 577-591.

9. Further, it is my opinion that if one of ordinary skill in the art were to combine Baardman's activators with Sumi, Buchwald and Zhang's catalysts, one would expect the large excess of borate to be deleterious as it would inhibit the catalytic cycle described above in paragraph 5 (Fox et al. Scheme 1). Thus one skilled in the art would not add an acidic borate to a reaction scheme that is facilitated by a base. Even if enough of a strong base were added to neutralize the acidic borate, at most, small molecules would be produced because it is generally the catalyst that controls the product made and one would expect products similar to those produced in Sumi, Buchwald and Zhang.

10. It is my further opinion that halogen ligands and hydrocarbyl ligands are not equivalent in all catalyst systems at all times. First halogen ligands are considered electron withdrawing, whereas hydrocarbyl ligands are typically

considered electron donating. Second, in many systems, a borate activator in combination with a halogenated catalyst precursor (e.g. Cp_2ZrCl_2) produces an inactive system while an alkylated precursor (e.g. Cp_2ZrMe_2) will likely, but not always, produce an active system. Thus, halogens and hydrocarbyls are not equivalent, particularly in borate activator containing systems.

Additionally, Qian is directed to polymerizing styrene, not to oligomerizing or polymerizing alpha-olefins as in my application. As such, a trend seen in Qian can not necessarily be equated with a different type of polymerization process. Qian is focused on changing the Cp' or R* of $Cp'TiCl_2(OR^*)$. Qian states, "in order to study how the changes of pi-donor ligand and sigma-donor ligand affect the catalytic activity and the properties of s-PS, this work aims to design and prepare a series of $Cp'TiCl_2(OR^*)$ complexes with different substituents in Cp and OR*, and then to apply them to the production of s-PS." Since $Cp'TiCl_3$/MAO is known to be a styrene polymerization catalyst, perhaps the Examiner is comparing the OR* of Qian to Cl, but OR* is not a hydrocarbyl, nor is it an abstractable ligand/leaving group in this catalyst system. The conclusion in Qian states, "through the polymerization testing we can conclude that the environment of cyclopentadiene plays a major role in the series of $Cp'TiCl_2(OR^*)$ /MAO catalytic systems, and that the influence of OR* is relatively weak." Qian's conclusion does not mean that R* has little effect, it means that in comparison to changing the substituents on the Cp ring, it has little effect for the polymerization of styrene.

Furthermore, it is commonly known in polymerization catalysis that changing the leaving group can affect catalyst activity, polymer molecular weight, and when applicable, polymer tacticity. For example, Kaminsky et al. reported that the styrene polymerization activity of fluorinated complexes $Cp'TiF_3$/MAO (Cp'= Cp, Cp*, MeCp, $EtMe_4Cp$, etc.) was about 30-40 times higher than with analogous $Cp'TiCl_3$/MAO systems. The polymer molecular weight, melting point and syndiotacticity were also significantly higher. This higher activity and syndioselectivity of the fluoride catalysts as compared to the chloride analogs is attributed to a greater number of more stable Ti(III) active sites where the fluoride would be expected to better stabilize the Ti(III) oxidation state. See *Macromolecules* 1997, 30, 7647-7650. Similarly, in ethylene polymerization, McCullough et al. in US 6,632,901 report higher activity with Cp'_2ZrF_2 is used as compared to Cp'_2ZrCl_2

(Cp'=1,3-Me,BuCp, Me_4Cp, n-PrCp, etc.) Similarly, Pedeutour et al. (*Journal of Molecular Catalysis A: Chemical* 2001, 176, 87-94) studied the effect of the leaving group for rac-$Et(Ind)_2ZrX_2$ where X, the leaving group, was Cl, Me, NMe_2 or CH_2Ph. In this study, it was found that when X was hydrocarbyl (Me or CH_2Ph) that catalyst activity was not dependent on the MAO to pre-catalyst molar ratio (Al:Zr) over the range of about 150-2000. This was not the case for the Cl leaving group where the activity differed significantly from low Al:Zr of 150 (activity = 0) to a higher Al:Zr of 2000 (activity = 1290 kg/mol-hr). This study clearly shows that for a polymerization catalyst leaving group, hydrocarbyl in not equivalent to halide. Probably more relevant is US 7,247,687 (Cherkasov et al.) which deals with late transition metal polymerization catalysts. Cherkasov et al. demonstrate that the [1,4-bis-substituted)-1,4-diaza-1,3-butadiene]nickel(II) catecholate complexes are very different catalysts as compared to the dibromide analogs. Note that the two differ in the X leaving groups - two bromides vs. a chelating catecholate ligand. The dibromide complexes are known paramagnetic and typically hydrocarbon insoluble complexes while, the catecholate analogs are diamagnetic and hydrocarbon soluble (see column 2 for a discussion on paramagnetic complexes in the Background section and diamagnetic complexes in the Summary section). Comparison of the polymerization of a catecholate based catalyst vs. corresponding dibromide based catalyst (compare entries 8-11 with C6-C7 in Table 1, column 308) shows the catecholate to give higher activity as compared to the dibromide. While this study did not compare hydrocarbyl to halide, it does show that the nature of the leaving group affects catalyst activity in late transition metal catalyzed olefin polymerizations.

Since many examples exist to show that the leaving groups in olefin polymerization catalysis can have a major affect on catalyst activity, one skilled in the art would not assume that a hydrocarbyl leaving group is the same as a halogen leaving group in a Pd based catalyst system.

11. In light of this lack of equivalence and the other statements above, it is my opinion that one of ordinary skill in the art would not combine Sumi, Baardman and Qian because firstly Qian is not directed at comparing hydrocarbyl verses halogen leaving groups, but is a study of ligand substitution on mono-cyclopentadienyl titanium catalysts for styrene polymerizations; secondly, Sumi is not directed to olefin polymerization catalysis, but rather to small molecule synthesis using late transition

metal mediated coupling chemistry; and thirdly, Baardman is directed to the use of added borate activator in late metal catalyzed olefin/CO polymerizations.

12. It is my further opinion that one of ordinary skill in the art would not combine Zhang, Baardman and Qian because of the same reasons stated in paragraph 11 since Zhang, like Sumi, is directed to small molecule synthesis using late transition metal mediated coupling chemistry.

13. It is my further opinion that one of ordinary skill in the art would not combine Buchwald and Qian because of the same reasons stated in paragraph 11 since Buchwald, like Sumi, is directed to small molecule synthesis using late transition metal mediated coupling chemistry.

14. It is my further opinion that one of ordinary skill in the art reading Piekarski, would find Piekarski is directed to early transition metal polymerization catalysts. Piekarski uses group 4-6 metals activated by a dialkylaluminum hydride-hydrogenpolysiloxane reaction product to make polyethylene. More specifically, the group 4-6 metals are $TiX_{4-n}(OR")_n$ or $VX_{4-n}(OR")_n$ or $VOX_{3-n}(OR")_n$. The reaction of the dialkylaluminum hydride with the hydrogenpolysiloxane is not the support, and in fact, the patent states that the reaction product is a slightly viscous material (col. 5, lines 20-23). Supports are merely an addition to what is described in the patent. Piekarski teaches very little regarding supports, but his brief statement regarding increased catalyst activity when supported refers to the ability to lower the amount of catalyst needed so that is does not need to be removed from the polymer (col. 7, lines 18-39). This is a moot teaching for an oligomerization catalyst, because in any case, the support would need to be filtered from the liquid olefin. Additionally Piekarski gives no indication or hint that using a late transition metal catalyst with an activator on a support would produce oligomers.

15. It is my further opinion that it is not automatic that catalyst activity is increased by putting a catalyst compound on a support. There are many systems where putting the catalyst on a support actually reduces "activity". For example, if the support contains functional groups that interact with the catalyst, portions of the catalyst can actually be deactivated causing a reduction in polymerization activity. Additionally, for catalysts that have datively bonded ancillary ligands, if the support is not chosen wisely, the ancillary ligand may be displaced by stronger donor groups on

the support. These are just two of many examples where catalyst activity could be reduced by use of a support.

16. At the time the '827 application was filed, very few catalyst systems were known that combined good catalyst activity with the production of linear olefins, with a particular preference for lower alpha-olefins. Additionally, the hydrocarbon solubility of my catalyst precursor allowed for readily supporting the catalyst which can have advantages in certain processes, for example, a fixed bed process. And it is possible (but yet unproven) that the reason behind the unusual catalysis of my catalyst system, is that most four-coordinate Ni(II) complexes prefer the planar geometry since the planar ligand set allows for the d-electrons to avoid occupying antibonding orbitals. My Ni(II) four-coordinate complexes were determined to be tetrahedral in geometry meaning that d-electrons occupying the antibonding orbitals is unavoidable, hence the fact that these complexes are also paramagnetic.

17. In light of the above, it is my opinion as one of ordinary skill in the art that the foregoing clearly indicates that the catalyst described and claimed in my '827 Patent Application represents a technological break-through as perceived by those skilled in the field of transition metal catalysis.

18. *I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the patent.*

Date: July 7, 2008 Jo Ann M Canich

Jo Ann Marie Canich, Ph.D.

CURRICULUM VITAE

JO ANN MARIE CANICH

Office Address: ExxonMobil Chemical Company
Baytown Technology and Engineering Complex - West
5200 Bayway Drive
Baytown, TX 77520

Industrial Positions:

- ExxonMobil Chemical Company -- Core Technology
    - Product Technology, Organometallic Catalysis Group (11/07-present)
        - Team Leader - Block Copolymers Team 1/08-present
    - Catalysis Process R&D, Organometallic Catalysis Group (1/07-11/07)
- Univation Technology: Catalyst R&D (1/04-1/07)
- Exxon or ExxonMobil Chemical Company - Core Technology
    - Catalysis Process R&D, Organometallic Catalysis Group (6/02-12/03)
        - Intellectual Property Coordination (12/02-12/03)
    - Polymer Science Division, Catalysis & Process Science Group (5/99-5/02)
    - Polymer Science Division, Solid State and Molecular Modeling Group (1/96-4/99)
        - Team Leader - Exploratory Catalyst Team 1/96-12/97
        - Team Leader - Solution Metallocene Elastomers Team (1/98-12/98)
    - Exxpol Catalysis Group (2/93-1/96)
    - Polymer Science Division, Catalysis Group (9/87-2/93)

Awards:

- ExxonMobil Chemical Company - CPR&D Research Award 2003
- American Society of Patent Holders Distinguished Corporate Inventors 1998
- Exxon Chemical Polymers Technology Award 1997
- Exxon Chemical, Baytown Polymers Center, Extra Mile Award 1995
- Exxon Chemical, Polymer Science, Where the Tire Meets the Road Award 1990
- Iota Sigma Pi National Anna Louise Hoffman Award 1987

Education:

8/84 - 5/87 Texas A&M University
College Station, Texas
Ph.D. Inorganic Chemistry (8/87)

- 1A -

Advisor: F. A. Cotton
Thesis: Oxidative Addition Chemistry of Group V and VI Metal Dimers

9/77 - 7/84 Portland State University
Portland, Oregon
M. S. Chemistry (6/84)
B. S. Chemistry (6/81)
Advisor, G. L. Gard
Thesis: Derivatives of Trifluorosulfur Pentafluoride and F-(tert-butyl) Hypochlorite

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X. APPENDIX: RELATED PROCEEDINGS

USSN 10/693,584, filed October 24, 2003 is also under appeal, no decisions have been reached as of the filling date of this Brief.